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10/753,138

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EXAMINER

MULLER, BRYAN R

ART UNIT

PAPER NUMBER

3723

DATE MAILED: 07/31/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/753,138

Applicant(s)

DE REGE THESAURO ET AL.

Examiner

Bryan R. Muller

Art Unit

3723

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 09 May 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-3,6-10,13-19,21 and 32-43 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-3,6-10,13-19,21 and 32-43 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-3, 6-9, 13-19, 21, 32-37, 39, 40, 41 and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ina et al (6,139,763) in view of Hartner et al (2002/0086511).

3. In reference to claim 1, Ina discloses a polishing composition for use in a CMP polishing system, wherein the method of use comprises, providing a substrate comprising a metal in oxidized form (tantalum oxide), contacting a portion of the substrate with a CMP polishing system comprising a polishing pad (col. 10, lines 34-37) and a polishing composition (with water as a liquid carrier) with abrasive particles (abstract) and a reducing agent (abstract) therein and abrading at least a portion of the metal oxidized form to polish the substrate. Ina further discloses that the reducing agent may be formic acid or formaldehyde (col. 6, lines 29-32). Ina however fails to disclose that the metal in oxidized form may be a noble metal selected from the group consisting of platinum, iridium, ruthenium, rhodium, palladium, silver, osmium, gold and combinations thereof. Hartner discloses a method for fabricating a patterned layer on a substrate that incorporates a step of chemical mechanical polishing a layer of iridium

oxide (paragraphs 43 and 44) to produce a layer on the substrate that is self-aligned and self-patterned. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the oxidized metal to be polished in the method of Ina may have been iridium oxide as used in the method of Hartner to produce a layer on the substrate that is self-aligned and self-patterned. This would have been advantageous because the pattern would not have to be etched, which is difficult and creates another step in the process, thus saving time and increasing production. Further, although the reducing agent of Ina has a higher redox potential than the tantalum barrier layer disclosed by Ina, the only reason this is necessary is to oxidize the tantalum layer. However, the combination of the Ina reference with the Hartner reference to polish the barrier layer of Iridium Oxide using the method of Ina merely uses the process of Ina to polish a substrate having Iridium that has already been oxidized. Therefore, it is not necessary that the reducing agent of Ina have a larger redox potential than the Iridium Oxide, because the Iridium is already oxidized, and neither Ina nor Hartner disclose that any of the components in the Ina process have a higher redox potential than the Iridium Oxide. Further, it can be assumed that the reducing agent of Ina does not have a redox potential higher redox potential than the Iridium Oxide of Hartner, because the polishing system of Ina has all of the same components of the claimed polishing system and the applicant discloses that the claimed polishing system does not have any components that have a redox potential that is greater than the redox potential of the metal in oxidized form. Therefore, the lack of a component having a redox potential higher than the redox potential of the metal in

oxidized form appears to be an inherent property of the claimed polishing system, which is essentially the same as the polishing system disclosed by Ina.

4. In reference to claim 2, the obvious combination of Ina and Hartner discloses polishing a substrate comprising iridium oxide, which is an oxide form of oxidation.

5. In reference to claim 3, the molecular formula for iridium Oxide is "IrO<sub>2</sub>", which is equivalent to Ir<sub>1</sub>O<sub>2</sub>. Therefore, in the form M<sub>x</sub>O<sub>y</sub>, y is greater than x.

6. In reference to claim 6, the obvious combination of Ina and Hartner discloses polishing a substrate comprising iridium oxide, as discussed supra.

7. In reference to claims 7-9, 13 and 14, Ina discloses that the reducing agent may be formic acid, as discussed supra, and that the abrasive disposed in the liquid carrier may be silica or fumed alumina (Col. 4, lines 16-22).

8. In reference to claims 10, 15 and 19, Ina further discloses that the abrasive may be α-alumina (Col. 4, line 19).

9. In reference to claims 16-18, Ina discloses that the abrasive suspended in the liquid carrier (slurry), may include silica or fumed alumina, as discussed supra.

10. In reference to claim 21, Ina discloses that the reducing agent may comprise between 0.002 and 0.1 mol/L of the complexing solution (Col. 4, lines 44-47). Using the molecular weight of formic acid (46.03 g/mol) and the fact that one Liter of water weighs approximately 1000g, it can be calculated that the % weight of the reducing agent in the composition is approximately between 0.092 and 0.46% by weight. This range overlaps the claimed range and thus, anticipates the claimed range (see MPEP § 2131.03 [R-2]).

11. In reference to claim 32, Ina further discloses that the liquid carrier may be water (abstract).

12. In reference to claim 33, Ina further discloses that the CMP system comprises a chelating agent (col. 7, lines 15-26), which is the same as a complexing agent, as disclosed by the applicant in paragraph 28 of the specification.

13. In reference to claim 34, Ina further discloses that the CMP system comprises a pH-adjusting agent to improve stability of the polishing composition (col. 8, lines 53-57). The definition of buffering is "a substance that minimizes change in the acidity of a solution when an acid or base is added to the solution" (*The American Heritage® Dictionary of the English Language, Fourth Edition Copyright © 2000 by Houghton Mifflin Company. Published by Houghton Mifflin Company. All rights reserved.*), thus the pH-adjusting agent, as disclosed by Ina, is a pH buffering agent in that it improves stability.

14. In reference to claim 35, Ina discloses that the composition may comprise surfactants (col. 8, line 53-55).

15. In reference to claims 36 and 37, the obvious combination of Ina and Hartner discloses the polishing method, as discussed supra in reference to claim 1, and Ina further discloses that the reducing agent may be present in the amount of 0.092-0.46 wt% based on the weight of the liquid carrier and any components dissolved or suspended therein, as discussed supra with reference to claim 21.

16. In reference to claim 39, the obvious combination of Ina and Hartner discloses the polishing method, as discussed supra in reference to claim 1, and Ina further

discloses that the polishing component **may** comprise abrasive particles of  $\alpha$ -alumina or fumed alumina, and provides several other abrasives that may be used. Thus, the polishing system, as disclosed by Ina may have several embodiments that do not comprise a mixture of  $\alpha$ -alumina and fumed alumina.

17. In reference to claims 40, 41 and 43, Ina further discloses that the preferred pH range of the polishing composition is between 1 and 7 (col. 8, lines 65-67).

18. Claims 38 and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sun et al (2002/0090820) in view of Hartner et al (2002/0086511) and Ina et al (6,139,763).

19. Sun discloses a method for polishing a metal in an oxidized form comprising the steps of providing a substrate comprising a metal in oxidized form (paragraph 31 discloses that the substrate may comprise silicon dioxide, wherein silicon is a semi-metallic element and silicon dioxide is an oxidized form of silicon, thus an oxidized metal), contacting a portion of the substrate with a CMP polishing system (paragraph 23) comprising a polishing element of abrasive particles and/or a polishing pad (abstract), a reducing agent (that may be oxalic acid; paragraph 50) and a liquid carrier (water) and abrading at least a portion of the metal in an oxidized form to polish the substrate. Sun further discloses that the polishing system **may** comprise an oxidizing agent (chelating agent), thus the polishing system, as disclosed by Sun does not require an oxidizing agent and would therefore have at least one embodiment that does not contain an oxidizing agent. Sun, however, fails to disclose that the metal in an oxidized

form is a noble metal selected from the claimed group or that the reducing agent is one of the reducing agents from the claimed group. Hartner discloses a method for fabricating a patterned layer on a substrate that incorporates a step of chemical mechanical polishing (CMP) a layer of iridium oxide (paragraphs 43 and 44) to produce a layer on the substrate that is self-aligned and self-patterned. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the oxidized metal to be polished in the method of Sun may have been iridium oxide as used in the method of Hartner to produce a layer on the substrate that is self-aligned and self-patterned. This would have been advantageous because the pattern would not have to be etched, which is difficult and creates another step in the process, thus saving time and increasing production. Further, Ina discloses a method of polishing a substrate comprising a metal in oxidized form, as discussed supra, that is similar to the method of Sun, both of which are intended to be used on substrates comprising tantalum. Ina further discloses that suitable reducing agent for such a substrate are formic acid, formaldehyde and oxalic acid (Col. 6, lines 30-33), thus teaching that formic acid and formaldehyde are possible equivalents of oxalic acid for acting as a reducing agent in a polishing compound for a substrate comprising tantalum and a metal in oxidized form. Therefore, it further would have been obvious to one of ordinary skill in the art at the time the invention was made that formic acid or formaldehyde may be used in place of oxalic acid as a reducing agent in the polishing composition.



20. In reference to claim 42, Sun further discloses that the preferred pH range of the polishing composition is between 2.5 and 11 (paragraph 44), which overlaps the claimed range, thus anticipating the claimed range (see MPEP 2131.03 [R-2]).

### ***Response to Arguments***

21. Applicant's arguments filed 5/11/2006 have been fully considered but they are not persuasive.

22. First the applicant argues that the Ina reference comprises components having a higher redox potential than the tantalum, which is part of the substrate in the Ina reference. However, the claim is that the component does not have a higher redox potential than the redox potential of the **oxidized** metal. It is well known that as the metal oxidizes, the redox potential of the oxidized metal increases and the redox potential of the reducing agent decreases, therefore, the reducing agent of Ina does not necessarily have a greater redox potential than the redox potential of the metal after the metal is oxidized. Additionally, the examiner makes the rejection based on a combination of the Ina reference and the Hartner reference to use the polishing process of Ina to polish the substrate of Hartner, which has Iridium Oxide as a barrier layer instead of tantalum or Tantalum Oxide. Therefore, the metal of the barrier layer is already presented in oxidized form, so the reducing agent of the Ina reference does not require a higher redox potential than the redox potential of the Iridium Oxide because the main purpose of the reducing agent in the Ina reference is to oxidize the Tantalum. Further, it is not disclosed that the reducing agent of Ina has a higher redox potential

than the redox potential of Iridium Oxide and it can be assumed that the polishing system of Ina does not have higher redox potential than the Iridium Oxide of Hartner, because the polishing system of Ina has all of the same components of the claimed polishing system and the applicant discloses that the claimed polishing system does not have any components that have a redox potential that is greater than the redox potential of the metal in oxidized form, as discussed supra.

23. Second, the applicant argues that there is no motivation to combine the Ina reference with the Hartner reference to make it obvious to polish the substrate of Hartner using the process of Ina. However, the examiner maintains the argument that the Hartner reference discloses polishing the substrate using a CMP process, but does not require any specific CMP process, thus inferring that any standard CMP process may be used. Also, the Ina reference discloses a CMP process, that has the advantages of polishing at a high stock removal rate, providing a high selectivity ratio (which reduces dishing effects) and producing semiconductor devices in good yield, over the standard CMP processes. Thus, the CMP process, disclosed by Ina, having advantages over standard CMP processes, taken in view of the disclosure of Hartner that any standard CMP process is effective for polishing the substrate comprising Iridium Oxide, provides motivation to use the CMP process of Ina with the substrate of Hartner to not only sufficiently polish the substrate, as disclosed by Hartner, but also to provide the additional advantages disclosed by Ina.

24. The applicant also argues that the Sun reference fails to disclose all of the claimed subject matter of claim 38. In response, the examiner points out that this is the

reason that the Sun reference is provided with secondary references for a rejection under 35 U.S.C. 103(a) instead of an anticipatory rejection under 35 U.S.C. 102.

25. The applicant additionally argues that the previous argument compares the Silicon Dioxide of Sun to the Iridium Oxide of the Hartner reference to provide motivation to combine and that the Sun reference teaches away from polishing a substrate comprising a noble metal in oxidized form because the Sun reference teaches the removal of the barrier layer. However, the examiner is merely references the Silicon Dioxide of Sun to argue that the Sun reference discloses a method of polishing an oxidized metal and does not reference the Similarity of Silicon Dioxide and Iridium Oxide as motivation to combine the references. The motivation to combine the Sun and Hartner references is to provide the Sun process with a method of producing a layer on the substrate that is self-aligned and self-patterned, as discussed supra, and the same motivation may be applied to combine Sun and Hartner as is provided for the combination of Ina and Hartner (that Hartner discloses a standard CMP process, and Sun discloses a CMP process that has the advantage of selective removal of the barrier layer, which reduces the dishing effect). The Silicone Dioxide of Sun is used as a dielectric layer, which may also be used as the dielectric layer of Hartner, thus, the Sun process would provide the same advantages to the substrate of Hartner as to the substrate disclosed by Sun of the suppression of removal of the dielectric layer. Further, the teaching of the Sun reference to remove the barrier layer, is also the desire of the Hartner reference, wherein the barrier layer of Hartner is the Iridium Oxide, thus

the selectivity of the barrier layer to the dielectric layer, that is provided by Sun, will also provide the same advantages to the Hartner substrate.

26. Finally the applicant argues that the teaching of the Ina reference to substitute the oxalic acid of Sun with formaldehyde or formic acid will provide the same suppression of the silicon dioxide removal. The examiner responds that, the suppression of the silicon dioxide layer is the advantage provided by both the Ina reference and the Sun reference, therefore, it would be desired that the alternate reducing agents disclosed by Ina, provide the same suppression of the removal of the silicon dioxide layer, when used in place of the oxalic acid of Sun.

27. Thus, the examiner maintains all of the rejections made in the previous office action and uses the same combination of references to reject new claims 40-43.

### ***Conclusion***

28. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Bryan R. Muller whose telephone number is (571) 272-4489. The examiner can normally be reached on Monday thru Thursday and second Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph J. Hail III can be reached on (571) 272-4485. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



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